Chapter G6: Benefits Analysis for the Seabrook and Pilgrim Facilities

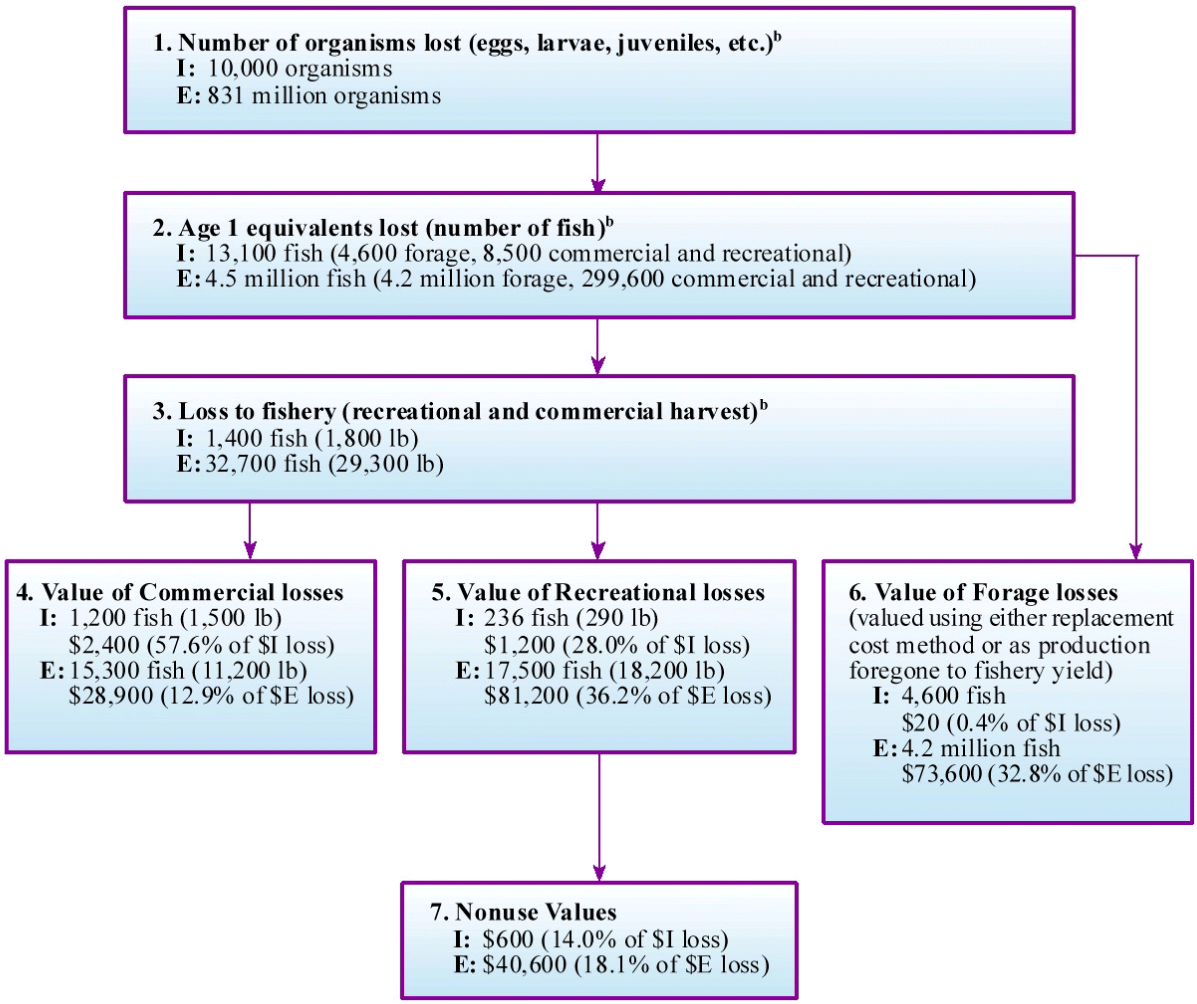
This chapter presents the results of EPA's evaluation of the economic benefits associated with reductions in I&E at the Seabrook and Pilgrim facilities. The economic benefits that are reported here are based on the values presented in Chapter G4 and EPA's estimates of current I&E at these facilities (discussed in Chapter G3). Section G6-1 presents a summary of I&E losses and associated economic values. Section G6-2 presents economic losses at Pilgrim expressed in terms of habitat replacement costs (HRC), as discussed in Chapter G5. Section G6-3 discusses potential benefits of reductions in I&E based on both the benefits transfer approach presented in Chapter G4 and the HRC approach presented in Chapter G5. Section G6-4 discusses the uncertainties in the benefits analysis.

Chapter Contents

G6-1 Overview of I&E and Associated Economic Values

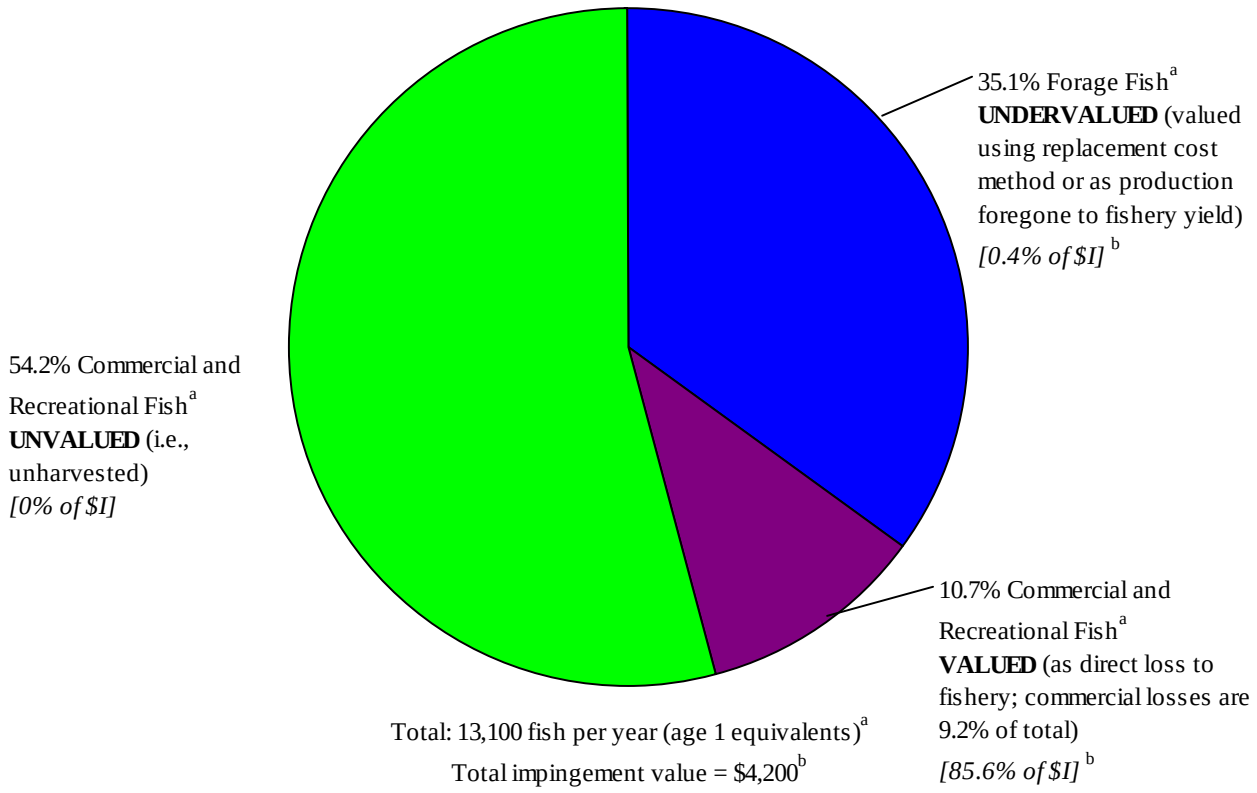
The flowchart in Figure G6-1 summarizes how economic values of I&E losses at Seabrook were derived from the I&E estimates discussed in Chapter G3. Figures G6-2 and G6-3 indicate the distribution of Seabrook's I&E losses by species category and associated economic values. Figures G6-4 through G6-6 present this information for the Pilgrim facility. These diagrams reflect baseline losses based on current technology. All dollar values and percentages of losses reflect midpoints of the ranges for the categories of commercial, recreational, nonuse, and forage values.

Figure G6-1: Overview and Summary of Average Annual I&E at the Seabrook Facility and Associated Economic Values (based on current configuration; all results are annualized)[a]



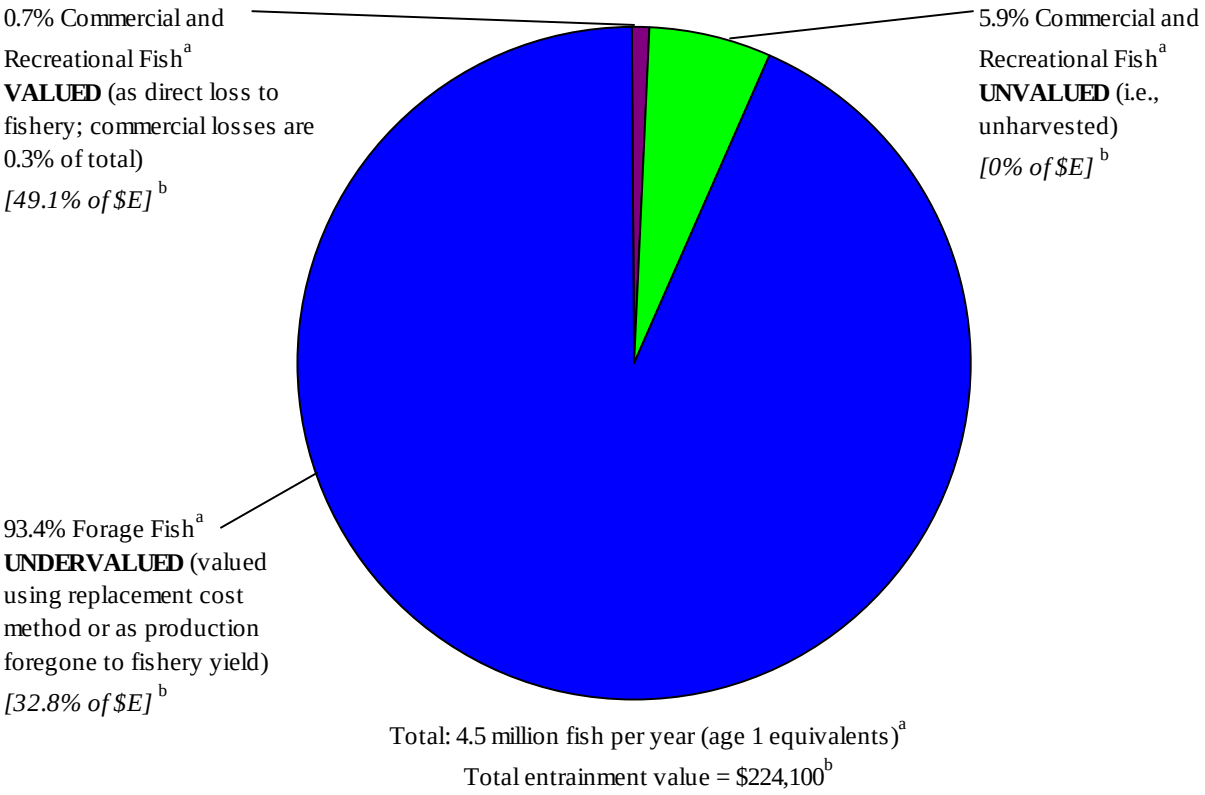
[a] All dollar values are the midpoint of the range of estimates.
[b] From Tables G4-2, G4-4, G4-15 and G4-16 of Chapter G4.
Note: Species with I&E <1% of the total I&E were not valued.

Figure G6-2: Seabrook: Distribution of Impingement Losses by Species Category



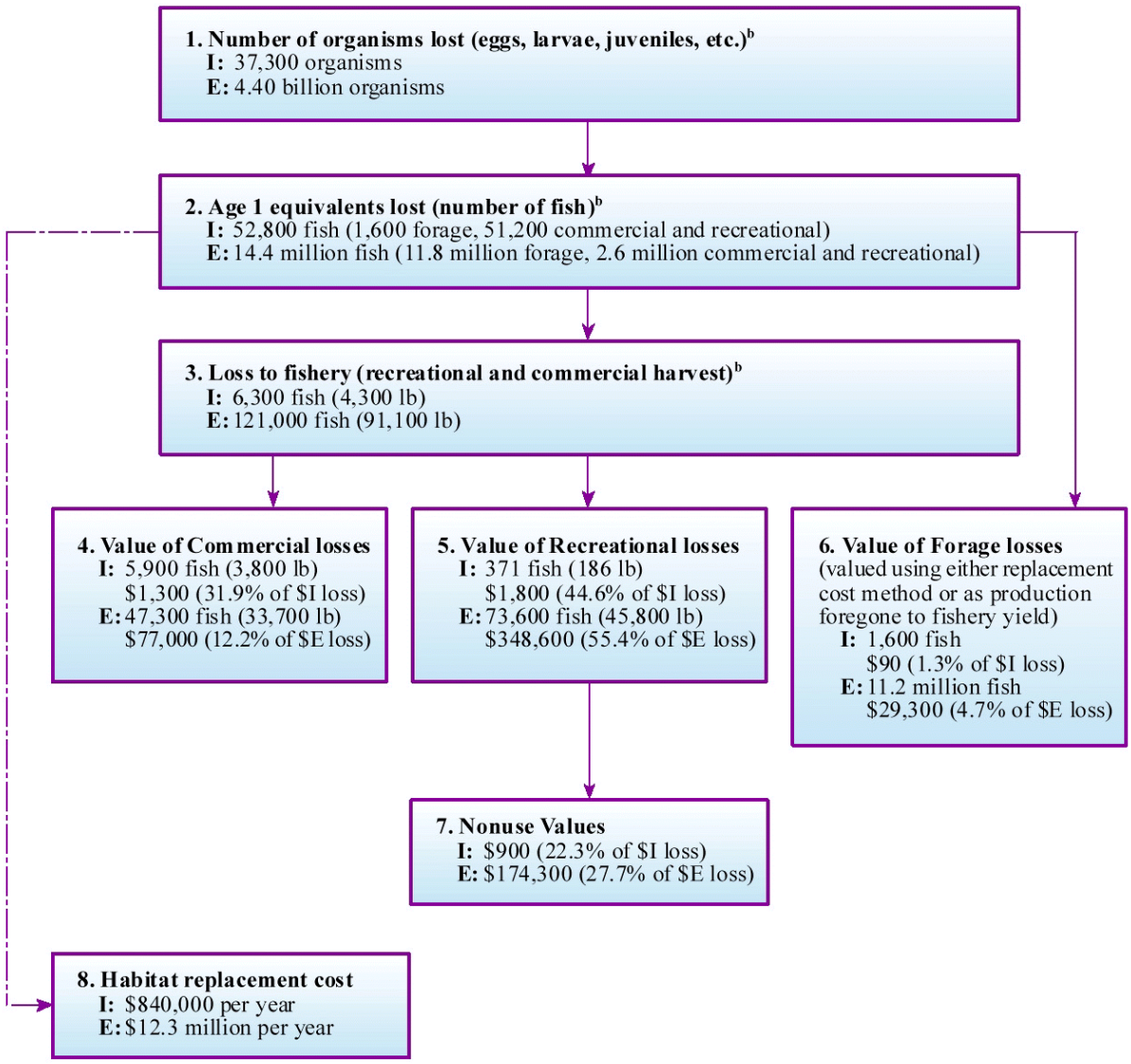
[a] Impacts shown are to age 1 equivalent fish, except impacts to the commercially and recreationally harvested fish include impacts for all ages vulnerable to the fishery.
[b] Midpoint of estimated range. Nonuse values are 14.0% of total estimated $I loss.

Figure G6-3: Seabrook: Distribution of Entrainment Losses by Species Category



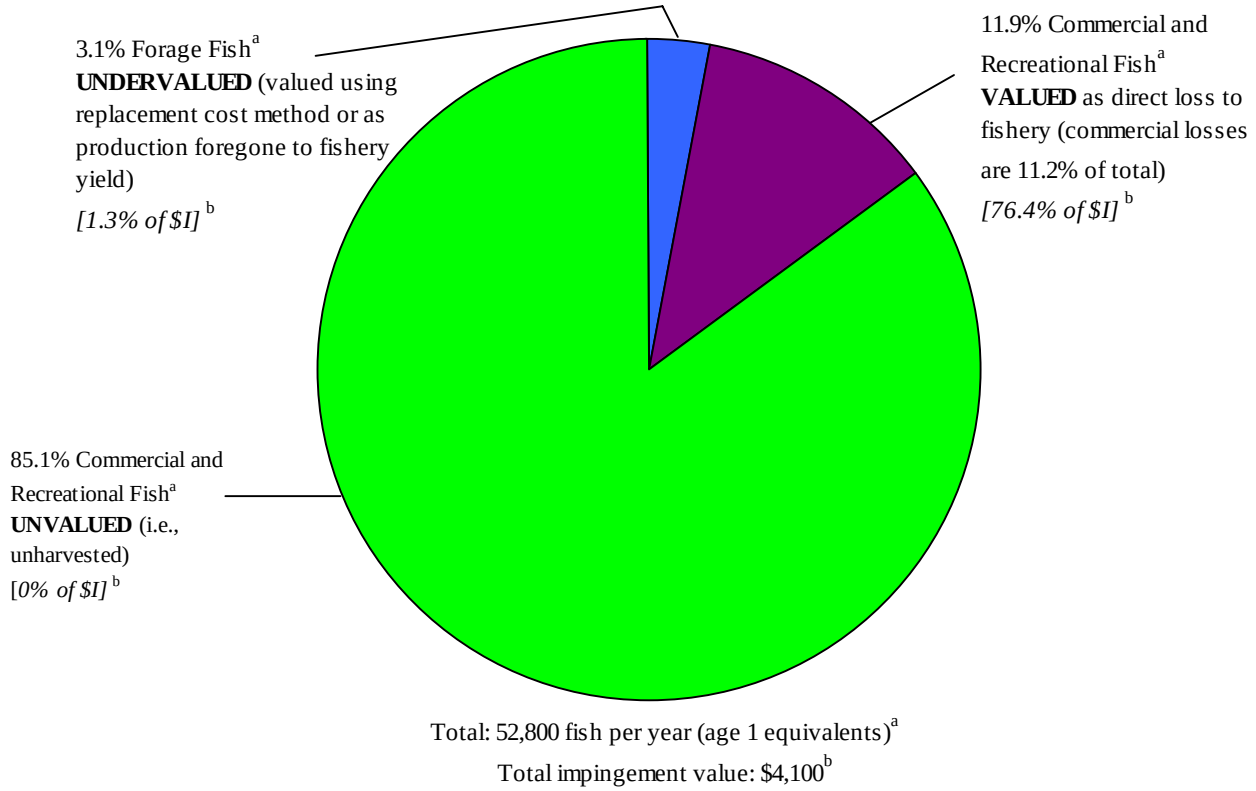
[a] Impacts shown are to age 1 equivalent fish, except impacts to the commercially and recreationally harvested fish include impacts for all ages vulnerable to the fishery.
[b] Midpoint of estimated range. Nonuse values are 18.1% of total estimated $E loss.

Figure G6-4: Overview and Summary of Average Annual I&E at the Pilgrim Facility and Associated Economic Values (based on current configuration; all results are annualized)[a]



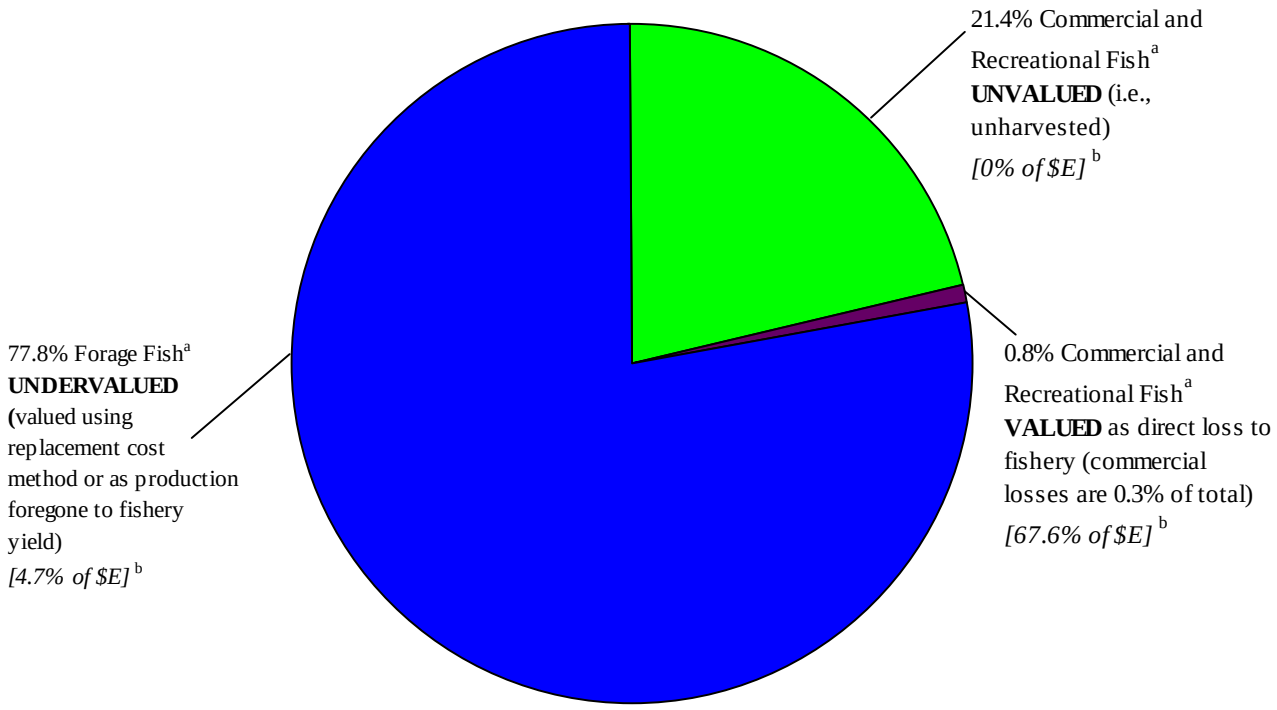
[a] All dollar values are the midpoint of the range of estimates.
[b] From Tables G4-3, G4-5, G4-17, and G4-18 of Chapter G4.
Note: Species with I&E <1% of the total I&E were not valued.

Figure G6-5: Pilgrim: Distribution of Impingement Losses by Species Category and Associated Economic Values



[a] Impacts shown are to age 1 equivalent fish, except impacts to the commercially and recreationally harvested fish include impacts for all ages vulnerable to the fishery.
[b] Midpoint of estimated range. Nonuse values are 22.3% of total estimated $I loss.

Figure G6-6: Pilgrim: Distribution of Entrainment Losses by Species Category and Associated Economic Values



Total: 14.4 million fish per year (age 1 equivalents)[a]

Total entrainment value = $628,800[b]

[a] Impacts shown are to age 1 equivalent fish, except impacts to the commercially and recreationally harvested fish include impacts to all ages vulnerable to the fishery.

[b] Midpoint of estimated range. Nonuse values are 27.7% of total estimated $E loss.

G6-2 Baseline Losses Using HRC Method

Chapter G5 presented baseline economic losses using the HRC approach. Baseline losses for I&E are $0.5 million and $9.1 million per year, respectively, for Pilgrim. These HRC values were used as an upper bound of I&E losses, while the midpoint of the benefits transfer values were used as a lower bound. The HRC approach was not applied to I&E for Seabrook.

G6-3 Anticipated Economic Benefits of Reduced I&E from Various Technologies

Tables G6-1 and G6-2 show the estimated economic benefits of various I&E reductions at the Seabrook and Pilgrim facilities, respectively. The benefits of reducing I&E at Seabrook are expected to range from $2,000 to $3,000 per year for a 60% reduction in impingement and from $97,000 to $216,000 per year for a 70% reduction in entrainment. The benefits of reducing I&E at Pilgrim are expected to range from $2,000 to $298,000 per year for a 60% reduction in impingement and from $440,000 to over $6.4 million per year for a 70% reduction in entrainment.

Note that the results derived for Pilgrim reflect loss estimates derived from an HRC analysis; similar HRC findings are not available for Seabrook. This is a key reason why the Pilgrim losses are much higher than the Seabrook estimates, at the upper end of the range.

Table G6-1: Summary of Current Economic Losses and Benefits of a Range of Potential I&E Reductions at Seabrook Facility ($2000)

		Impingement	Entrainment	Total
Baseline losses	low	$3,000	$139,000	$142,000
	high	$5,000	$309,000	$314,000
Benefits of 10% reductions	low	$0	$14,000	$14,000
	high	$1,000	$31,000	$31,000
Benefits of 20% reductions	low	$1,000	$28,000	$28,000
	high	$1,000	$62,000	$63,000
Benefits of 30% reductions	low	$1,000	$42,000	$43,000
	high	$2,000	$93,000	$94,000
Benefits of 40% reductions	low	$1,000	$56,000	$57,000
	high	$2,000	$124,000	$126,000
Benefits of 50% reductions	low	$2,000	$70,000	$71,000
	high	$3,000	$155,000	$157,000
Benefits of 60% reductions	low	$2,000	$83,000	$85,000
	high	$3,000	$185,000	$188,000
Benefits of 70% reductions	low	$2,000	$97,000	$99,000
	high	$4,000	$216,000	$220,000
Benefits of 80% reductions	low	$2,000	$111,000	$114,000
	high	$4,000	$247,000	$251,000
Benefits of 90% reductions	low	$3,000	$125,000	$128,000
	high	$5,000	$278,000	$283,000

Table G6-2: Summary of Current Economic Losses and Benefits of a Range of Potential I&E Reductions at Pilgrim Facility ($2000)

		Impingement	Entrainment	Total
Baseline losses	low	$4,000	$629,000	$633,000
	high	$497,000	$9,097,000	$9,594,000
Benefits of 10% reductions	low	$0	$63,000	$63,000
	high	$50,000	$910,000	$959,000
Benefits of 20% reductions	low	$1,000	$126,000	$127,000
	high	$99,000	$1,819,000	$1,919,000
Benefits of 30% reductions	low	$1,000	$189,000	$190,000
	high	$149,000	$2,729,000	$2,878,000
Benefits of 40% reductions	low	$2,000	$252,000	$253,000
	high	$199,000	$3,639,000	$3,837,000
Benefits of 50% reductions	low	$2,000	$315,000	$317,000
	high	$248,000	$4,548,000	$4,797,000
Benefits of 60% reductions	low	$2,000	$377,000	$380,000
	high	$298,000	$5,458,000	$5,756,000
Benefits of 70% reductions	low	$3,000	$440,000	$443,000
	high	$348,000	$6,368,000	$6,716,000
Benefits of 80% reductions	low	$3,000	$503,000	$506,000
	high	$397,000	$7,277,000	$7,675,000
Benefits of 90% reductions	low	$4,000	$566,000	$570,000
	high	$447,000	$8,187,000	$8,634,000

G6-4 Summary of Omissions, Biases, and Uncertainties in the Benefits Analysis

Table G6-3 presents an overview of omissions, biases, and uncertainties in the benefits estimates. Factors with a negative impact on the benefits estimate bias the analysis downward, and therefore would raise the final estimate if they were properly accounted.

Table G6-3: Omissions, Biases, and Uncertainties in the Benefits Estimates

Issue	Impact on Benefits Estimate	Comments
Long-term fish stock affects not considered	Understates benefits[a]	EPA assumed that the effects on stocks are the same each year, and that the higher fish kills would not have cumulatively greater impact.
Effect of interaction with other environmental stressors	Understates benefits[a]	EPA did not analyze how the yearly reductions in fish may make the stock more vulnerable to other environmental stressors. In addition, as water quality improves over time due to other watershed activities, the number of fish impacted by I&E may increase.
Recreation participation is held constant[a]	Understates benefits[a]	Recreational benefits only reflect anticipated increase in value per activity outing; increased levels of participation are omitted.
Boating, bird-watching, and other in-stream or near-water activities are omitted[a]	Understates benefits[a]	The only impact to recreation considered is fishing.
HRC does not cover losses for all species	Understates benefits[a]	As a result of the HRC method, species with losses that are not addressed can only increase the HRC total valuation
Nonuse benefits	Uncertain	EPA assumed that nonuse benefits are 50 percent of recreational angling benefits
Effect of change in stocks on number of landings	Uncertain	EPA assumed a linear stock to harvest relationship, that a 13 percent change in stock would have a 13 percent change in landings; this may be low or high, depending on the condition of the stocks.
Recreation values for various geographic areas	Uncertain	The recreational values used are from various regions and are not from New England in particular.

[a] Benefits would be greater than estimated if this factor were considered.